

Empiric Therapy of Cardiovascular Infections

Subacute Bacterial Endocarditis (SBE)

Subset	Usual Pathogens	Preferred IV Therapy	Alternate IV Therapy	PO Therapy or IV-to-PO Switch
No obvious source	<i>S. viridans</i> Group B,C,G streptococci Nutritionally-variant streptococci	Ceftriaxone 2 gm (IV) q24h x 2 weeks plus Gentamicin 120 mg (IV) q24h x 2 weeks or monotherapy with Ceftriaxone 2 gm (IV) q24h x 2 weeks	Penicillin G 3 mu (IV) q4h x 2 weeks plus Gentamicin 180 mg (IV) q24h x 2 weeks or monotherapy with Vancomycin 1 gm (IV) q12h x 2 weeks or Linezolid 600 mg (IV) q12h x 2 weeks	Amoxicillin 1 gm (PO) q8h x 2 weeks or Linezolid 600 mg (PO) q12h x 2 weeks
GI/GU source likely (Treat initially for <i>E. faecalis</i> ; if later identified as <i>E. faecium</i> , treat accordingly)	<i>E. faecalis</i>	Vancomycin 1 gm (IV) q12h x 4-6 weeks plus Gentamicin 80 mg (IV) q8h x 4-6 weeks or monotherapy with Ampicillin 2 gm (IV) q4h x 4-6 weeks	Meropenem 1 gm (IV) q8h x 4-6 weeks or Imipenem 1 gm (IV) q6h x 4-6 weeks or Linezolid 600 mg (IV) q12h x 4-6 weeks	Amoxicillin 1 gm (PO) q8h x 4-6 weeks or Linezolid 600 mg (PO) q12h x 4-6 weeks
	<i>E. faecium</i> (VRE)	Linezolid 600 mg (IV) q12h x 4-6 weeks	Quinupristin/ dalfopristin 7.5 mg/kg (IV) q8h x 4-6 weeks	Linezolid 600 mg (PO) q12h x 4-6 weeks
	<i>S. bovis</i>	Treat the same as "no obvious source" subset, above		

Subacute Bacterial Endocarditis (SBE) (cont'd)

Subset	Usual Pathogens	Preferred IV Therapy	Alternate IV Therapy	PO Therapy or IV-to-PO Switch
Apparent "culture negative" SBE*	Hemophilus sp. Actinobacillus actinomycetem-comitans Cardiobacterium hominis Eikenella corrodens Kingella kingae	Ceftriaxone 2 gm (IV) q24h x 4 weeks or Any 3 rd generation cephalosporin (IV) x 4 weeks or Cefepime 2 gm (IV) q12h x 4 weeks	Ampicillin 2 gm (IV) q4h x 4 weeks plus either Gentamicin 120 mg (IV) q24h x 4 weeks or Levofloxacin 500 mg (IV) q24h x 4-6 weeks	Levofloxacin 500 mg (PO) q24h x 4 weeks or Ciprofloxacin 500 mg (PO) q12h x 4 weeks
True "culture negative" SBE*	Legionella Coxiella burnetii (Q fever) Chlamydia psittaci Brucella	Levofloxacin 500 mg (IV) q24h x 4-6 weeks	Doxycycline 200 mg (IV) q12h x 3 days, then 100 mg (IV) q12h x 4-6 weeks	Doxycycline 200 mg (PO) q12h x 3 days, then 100 mg (PO) q12h x 4-6 weeks** or Levofloxacin 500 mg (PO) q24h x 4-6 weeks

VRE = vancomycin-resistant enterococci. Duration of therapy represents total time IV, PO, or IV + PO. Most patients on IV therapy able to take PO meds should be switched to PO therapy soon after clinical improvement

* Treat only IV or IV-to-PO switch

** Loading dose is not needed PO if given IV with the same drug

Clinical Presentation: Subacute febrile illness ± localizing symptoms/signs in a patient with a heart murmur. Peripheral manifestations are commonly absent with early diagnosis/treatment
Diagnosis: Positive blood cultures plus vegetation on transthoracic/transesophageal echo

SBE (No Obvious Source)

Diagnostic Considerations: Most common pathogen is *S. viridans*. Source is usually from the mouth, although oral/dental infection is usually inapparent clinically

Pitfalls: Vegetations without positive blood cultures or peripheral manifestations of SBE are not diagnostic of endocarditis. SBE vegetations may persist after antibiotic therapy, but are sterile

Therapeutic Considerations: In penicillin-allergic (anaphylactic) patients, vancomycin may be used alone or in combination with gentamicin. Follow ESR weekly to monitor antibiotic response. No need to repeat blood cultures unless patient has persistent fever or is not responding clinically. Two-week treatment is acceptable for uncomplicated *S. viridans* SBE. Treat nutritionally-variant streptococci (*B_g*/pyridoxal deficient streptococci) the same as for *S. viridans* SBE

Prognosis: Related to extent of embolization/severity of heart failure

SBE (GI/GU Source Likely)

Diagnostic Considerations: Commonest pathogens from GI/GU source are Enterococci (especially *E. faecalis*). If *S. bovis*, look for GI polyp, tumor. Enterococcal SBE commonly follows GI/GU instrumentation

Therapeutic Considerations: *E. faecalis* SBE may be treated with ampicillin alone; gentamicin may be added if synergy testing is positive (e.g., isolate sensitive to < 500 mcg/mL of gentamicin). Do not

add gentamicin if MIC > 500 mcg/mL. For penicillin-allergic patients, use vancomycin plus gentamicin; vancomycin alone is inadequate for enterococcal (*E. faecalis*) SBE. Treat enterococcal PVE the same as for native valve enterococcal SBE. Treat *S. bovis* SBE the same as *S. viridans* SBE. Non-enterococcal Group D streptococci (*S. bovis*) is penicillin sensitive, unlike Group D enterococci (*E. faecalis*)

Prognosis: Related to extent of embolization/severity of heart failure

Apparent “Culture Negative” SBE

Diagnostic Considerations: Culture of HACEK organisms requires enhanced CO₂/special media (Castaneda vented bottles) and prolonged incubation (2-4 weeks). True “culture negative” SBE is rare, and is characterized by peripheral signs of SBE with a murmur, vegetation, and negative blood cultures

Pitfalls: Most cases of “culture negative” SBE are not really culture negative, but due to fastidious organisms (HACEK group) requiring prolonged incubation with enhanced CO₂ atmosphere for growth. Sterile vegetations may persist after antibiotic therapy

Therapeutic Considerations: Follow clinical improvement with serial ESRs, which should return to pretreatment levels with therapy. Verification of cure by blood culture is not needed if patient is afebrile and clinically well

Prognosis: Related to extent of embolization/severity of heart failure

True “Culture Negative” SBE

Diagnostic Considerations: Diagnosis by specific serology. Large vessel emboli suggests culture negative SBE in patients with negative blood cultures but signs of SBE

Pitfalls: Do not diagnose culture negative SBE in patients with a heart murmur and negative blood cultures if peripheral SBE manifestations are absent

Therapeutic Considerations: Treatment is based on specific organism identified by diagnostic tests

Prognosis: Related to extent of embolization/severity of heart failure

Acute Bacterial Endocarditis (ABE)

Subset	Usual Pathogens	Preferred IV Therapy	Alternate IV Therapy	PO Therapy or IV-to-PO Switch
Normal hosts* (Treat initially for MSSA; if later identified as MRSA, treat accordingly)	<i>S. aureus</i> (MSSA)	Nafcillin 2 gm (IV) q4h x 4-6 weeks or Meropenem 1 gm (IV) q8h x 4-6 weeks or Imipenem 1 gm (IV) q6h x 4-6 weeks	Linezolid 600 mg (IV) q12h x 4-6 weeks or Vancomycin 1 gm (IV) q12h x 4-6 weeks	Minocycline 100 mg (PO) q12h x 4-6 weeks or Cephalexin 1 gm (PO) q6h x 4-6 weeks or Linezolid 600 mg (PO) q12h x 4-6 weeks
	<i>S. aureus</i> (MRSA)	Vancomycin 1 gm (IV) q12h x 4-6 weeks or Linezolid 600 mg (IV) q12h x 4-6 weeks	Minocycline 100 mg (IV) q12h x 4-6 weeks	Linezolid 600 mg (PO) q12h x 4-6 weeks or Minocycline 100 mg (PO) q12h x 4-6 weeks

Acute Bacterial Endocarditis (ABE) (cont'd)

Subset	Usual Pathogens	Preferred IV Therapy	Alternate IV Therapy	PO Therapy or IV-to-PO Switch
IV drug abusers (Treat as MSSA before culture results; treat according to pathogen after culture results)	S. aureus (MSSA)	<u>Before culture results</u> Vancomycin 1 gm (IV) q12h plus either Gentamicin 120 mg (IV) q24h or Amikacin 500 mg (IV) q24h	<u>After culture results</u> Nafcillin 2 gm (IV) q4h x 4 weeks or Meropenem 1 gm (IV) q8h x 4 weeks or Imipenem 1 gm (IV) q6h x 4 weeks or Vancomycin 1 gm (IV) q12h x 4 weeks or Linezolid 600 mg (IV) q12h x 4 weeks	<u>After culture results</u> Linezolid 600 mg (PO) q12h x 4 weeks or Minocycline 100 mg (PO) q12h x 4 weeks or Cephalexin 1 gm (PO) q6h x 4 weeks
	S. aureus (MRSA)	<u>Before culture results</u> Treat the same as MSSA	<u>After culture results</u> Vancomycin 1 gm (IV) q12h x 4 weeks or Linezolid 600 mg (IV) q12h x 4 weeks or Minocycline 100 mg (IV) q12h x 4 weeks	<u>After culture results</u> Linezolid 600 mg (PO) q12h x 4 weeks or Minocycline 100 mg (PO) q12h x 4 weeks
	P. aeruginosa*	<u>Before culture results</u> Treat the same as MSSA	<u>After culture results</u> One "A" drug + one "B" drug "A" Drugs Piperacillin 4 gm (IV) q8h x 4-6 weeks or Cefepime 2 gm (IV) q8h x 4-6 weeks or Meropenem 1 gm (IV) q8h x 4-6 weeks "B" Drugs Amikacin 500 mg (IV) q24h x 4-6 weeks or Aztreonam 2 gm (IV) q8h x 4-6 weeks	<u>After culture results</u> Ciprofloxacin 750 mg (PO) q12h x 4-6 weeks

MSSA/MRSA = methicillin-sensitive/resistant *S. aureus*. Duration of therapy represents total time IV, PO, or IV + PO. Most patients on IV therapy able to take PO meds should be switched to PO therapy after clinical improvement
* Treat only IV or IV-to-PO switch

Acute Bacterial Endocarditis

Diagnostic Considerations: Patients are critically ill and febrile (temperature $\geq 102^{\circ}\text{F}$). Vegetations are almost always present

Pitfalls: Obtain a baseline echocardiogram; watch for valve destruction, heart failure, ring/perivalvular abscess. Obtain cardiology consultation

Therapeutic Considerations: Treat for 4-6 weeks. Follow teichoic acid antibody levels weekly in *S. aureus* ABE, which fall (along with the ESR) with effective therapy

Prognosis: Related to extent of embolization/severity of heart failure

Acute Bacterial Endocarditis (IV Drug Abusers)

Diagnostic Considerations: IVDA with *S. aureus* usually have mild ABE, permitting oral treatment

Pitfalls: IVDA with new aortic or tricuspid regurgitation should be treated IV \pm valve replacement

Therapeutic Considerations: After pathogen is isolated, may switch from IV to PO regimen to complete treatment course

Prognosis: Prognosis is better than for normal hosts (endocarditis usually milder) if not complicated by abscess, valve regurgitation, or heart failure

Prosthetic Valve Endocarditis (PVE)

Subset	Usual Pathogens	Before Culture Results	After Culture Results
Early PVE (< 60 days post-PVR)	<i>S. aureus</i> (MSSA/MRSA) Enterobacteriaceae	Vancomycin 1 gm (IV) q12h plus Gentamicin 120 mg (IV) q24h	<u>MSSA/Enterobacteriaceae</u> Cefotaxime 3 gm (IV) q6h x 4-6 weeks or Ceftizoxime 4 gm (IV) q8h x 4-6 weeks or Cefepime 2 gm (IV) q8-12h x 4-6 weeks or Meropenem 1 gm (IV) q8h x 4-6 weeks <u>MRSA</u> Vancomycin 1 gm (IV) q12h x 4-6 weeks* or Linezolid 600 mg (IV or PO) q12h x 4-6 weeks or Minocycline 100 mg (IV or PO) q12h x 4-6 weeks
Late PVE (> 60 days post-PVR)	<i>S. viridans</i> <i>S. epidermidis</i> (MSSE/MRSE)	Linezolid 600 mg (IV or PO) q12h or combination therapy with Vancomycin 1 gm (IV) q12h plus Gentamicin 120 mg (IV) q24h	<u><i>S. viridans</i></u> Ceftriaxone 2 gm (IV) q24h x 4-6 weeks or Cefotaxime 3 gm (IV) q6h x 4-6 weeks or Ceftizoxime 4 gm (IV) q8h x 4-6 weeks <u>MSSE/MRSE</u> Linezolid 600 mg (IV or PO) q12h x 4-6 weeks or Vancomycin 1 gm (IV) q12h x 4-6 weeks*

MSSA/MRSA = methicillin-sensitive/resistant *S. aureus*; MSSE/MRSE = methicillin-sensitive/resistant *S. epidermidis*. Duration of therapy represents total time IV or IV + PO. Most patients on IV therapy able to take PO meds should be switched to PO therapy after clinical improvement

* \pm Rifampin 300 mg (PO) q12h x 4-6 weeks

Clinical Presentation: Prolonged fevers and chills following prosthetic valve replacement (PVR)

Diagnosis: High-grade blood culture positivity (3/4 or 4/4) with endocarditis pathogen and no other source of infection

Early PVE (< 60 days post-PVR)

Diagnostic Considerations: Blood cultures persistently positive. Temperature usually $\leq 102^{\circ}\text{F}$

Pitfalls: Obtain baseline TTE/TEE. Premature closure of mitral leaflet is early sign of impending aortic valve regurgitation

Therapeutic Considerations: Patients improve clinically on treatment, but are not cured without valve replacement. Replace valve as soon as possible (no advantage in waiting)

Prognosis: Related to extent of embolization/severity of heart failure

Late PVE (> 60 days post-PVR)

Pitfalls: Culture of removed valve may be negative, but valve gram stain will be positive

Therapeutic Considerations: Late PVE resembles *S. viridans* SBE clinically. Valve removal for *S. epidermidis* PVE may be necessary for cure

Prognosis: Related to extent of embolization/severity of heart failure

Pericarditis/Myocarditis

Subset	Usual Pathogens	Preferred Therapy
Viral pericarditis/ myocarditis	Coxsackie virus	No treatment available
TB pericarditis	<i>M. tuberculosis</i>	Treat the same as pulmonary TB (p. 44)
Suppurative pericarditis	<i>S. pneumoniae</i> <i>S. aureus</i>	Treat the same as lung abscess/empyema (p. 49)

Clinical Presentation: Viral pericarditis presents with acute onset of fever/chest pain (made worse by sitting up) following a viral illness. Viral myocarditis presents with heart failure, arrhythmias \pm emboli. TB pericarditis is indolent in presentation, with \uparrow jugular venous distension (JVD), pericardial friction rub (40%), paradoxical pulse (25%), and chest x-ray with cardiomegaly \pm left-sided pleural effusion. Suppurative pericarditis presents as acute pericarditis (patients are critically ill). Develops from contiguous (e.g., pneumonia) or hematogenous spread (e.g., *S. aureus* bacteremia)

Diagnostic Considerations: Pericarditis/effusion manifests cardiomegaly with decreased heart sounds \pm tamponade. Diagnosis by culture/biopsy of pericardial fluid or pericardium for viruses, bacteria, or acid-fast bacilli (AFB). Diagnosis of myocarditis is clinical \pm myocardial biopsy

Pitfalls: Consider other causes of pericardial effusion (malignancy, especially with bloody effusion, uremia, etc.). Rule out treatable non-viral causes of myocarditis (e.g., RMSF, Lyme disease, diphtheria)

Therapeutic Considerations: No specific treatment for viral myocarditis/pericarditis. TB pericarditis is treated the same as pulmonary TB \pm pericardiectomy. Suppurative pericarditis is treated the same as lung abscess plus surgical drainage (pericardial window)

Prognosis: For viral pericarditis, the prognosis is good, but viral myocarditis may be fatal. For TB pericarditis, the prognosis is good if treated before constrictive pericarditis/adhesions develop. Suppurative pericarditis is often fatal without early pericardial window/antibiotic therapy

IV Line and Pacemaker Infections

Subset	Usual Pathogens	Preferred IV Therapy	Alternate IV Therapy	IV-to-PO Switch
Central IV line infection (temporary) (Treat initially for MSSA; if later identified as MRSA, treat accordingly)	S. aureus (MSSA) Enterobacteriaceae	Cefepime 2 gm (IV) q12h x 2 weeks after line removal or Meropenem 1 gm (IV) q8h x 2 weeks after line removal or Imipenem 1 gm (IV) q6h x 2 weeks after line removal	Ceftizoxime 2 gm (IV) q8h x 2 weeks after line removal or Cefotaxime 2 gm (IV) q6h x 2 weeks after line removal	Clindamycin 300 mg (PO) q8h x 2 weeks after line removal plus Levofloxacin 500 mg (PO) q24h x 2 weeks after line removal
	S. aureus (MRSA)	Linezolid 600 mg (IV) q12h x 2 weeks after line removal or Vancomycin 1 gm (IV) q12h x 2 weeks after line removal	Minocycline 100 mg (IV) q12h x 2 weeks after line removal or Quinupristin/dalfopristin 7.5 mg/kg (IV) q8h x 2 weeks after line removal	Linezolid 600 mg (PO) q12h x 2 weeks after line removal or Minocycline 100 mg (PO) q12h x 2 weeks after line removal
Central IV line infection (semi-permanent); Hickman/Broviac (Treat initially for S. aureus; if later identified as S. epidermidis, treat accordingly)	S. aureus (MSSA/MRSA)	Linezolid 600 mg (IV) q12h x 2 weeks after line removal or Vancomycin 1 gm (IV) q12h x 2 weeks after line removal	Minocycline 100 mg (IV) q12h x 2 weeks after line removal or Quinupristin/dalfopristin 7.5 mg/kg (IV) q8h x 2 weeks after line removal	Linezolid 600 mg (PO) q12h x 2 weeks after line removal or Minocycline 100 mg (PO) q12h x 2 weeks after line removal
	S. epidermidis (MSSE/MRSE)	Linezolid 600 mg (IV) q12h x 2 weeks after line removal or Vancomycin 1 gm (IV) q12h x 2 weeks after line removal	Cefepime 2 gm (IV) q12h x 2 weeks after line removal or Quinupristin/dalfopristin 7.5 mg/kg (IV) q8h x 2 weeks after line removal	Linezolid 600 mg (PO) q12h x 2 weeks after line removal or combination therapy with Clindamycin 300 mg (PO) q8h x 2 weeks after line removal plus Levofloxacin 500 mg (PO) q24h x 2 weeks after line removal

IV Line and Pacemaker Infections (cont'd)

Subset	Usual Pathogens	Preferred IV Therapy	Alternate IV Therapy	IV-to-PO Switch
Pacemaker wire/generator infection (Treat initially for <i>S. aureus</i> ; if later identified as <i>S. epidermidis</i> , treat accordingly)	<i>S. aureus</i> (MSSA/MRSA)	Linezolid 600 mg (IV) q12h x 2 weeks after wire/generator removal* or Vancomycin 1 gm (IV) q12h x 2 weeks after wire/generator removal*	Minocycline 100 mg (IV) q12h x 2 weeks after wire/generator removal* or Quinupristin/dalfopristin 7.5 mg/kg (IV) q8h x 2 weeks after wire/generator removal*	Linezolid 600 mg (PO) q12h x 2 weeks after wire/generator removal* or Minocycline 100 mg (PO) q12h x 2 weeks after wire/generator removal*
	<i>S. epidermidis</i> (MSSE/MRSE)	Linezolid 600 mg (IV) q12h x 2 weeks after wire/generator removal or Vancomycin 1 gm (IV) q12h x 2 weeks after wire/generator removal	Cefepime 2 gm (IV) q12h x 2 weeks after wire/generator removal or Quinupristin/dalfopristin 7.5 mg/kg (IV) q8h x 2 weeks after wire/generator removal	Linezolid 600 mg (PO) q12h x 2 weeks after wire/generator removal or combination therapy with Clindamycin 300 mg (PO) q8h x 2 weeks after wire/generator removal plus Levofloxacin 500 mg (PO) q24h x 2 weeks after wire/generator removal
Septic thrombophlebitis (Treat initially for MSSA; if later identified as MRSA, treat accordingly)	<i>S. aureus</i> (MSSA)	Nafcillin 2 gm (IV) q4h x 2 weeks* or Meropenem 1 gm (IV) q8h x 2 weeks* or Imipenem 1 gm (IV) q6h x 2 weeks* or Linezolid 600 mg (IV) q12h x 2 weeks*	Ceftizoxime 2 gm (IV) q8h x 2 weeks* or Cefotaxime 2 gm (IV) q6h x 2 weeks* or Quinupristin/dalfopristin 7.5 mg/kg (IV) q8h x 2 weeks*	Linezolid 600 mg (PO) q12h x 2 weeks* or combination therapy Clindamycin 300 mg (PO) q8h x 2 weeks* plus Levofloxacin 500 mg (PO) q24h x 2 weeks*

IV Line and Pacemaker Infections (cont'd)

Subset	Usual Pathogens	Preferred IV Therapy	Alternate IV Therapy	IV-to-PO Switch
Septic thrombophlebitis (cont'd)	<i>S. aureus</i> (MRSA)	Linezolid 600 mg (IV) q12h x 2 weeks* or Vancomycin 1 gm (IV) q12h x 2 weeks*	Minocycline 100 mg (IV) q12h x 2 weeks* or Quinupristin/dalfopristin 7.5 mg/kg (IV) q8h x 2 weeks*	Linezolid 600 mg (PO) q12h x 2 weeks* or Minocycline 100 mg (PO) q12h x 2 weeks*

MSSA/MRSA = methicillin-sensitive/resistant S. aureus; MSSE/MRSE = methicillin-sensitive/resistant S. epidermidis. Duration of therapy represents total time IV or IV + PO. Most patients on IV therapy able to take PO meds should be switched to PO therapy after clinical improvement

* Obtain teichoic acid antibody titers after 2 weeks. If titers are 1:4 or less, 2 weeks of therapy is sufficient. If titers are > 1:4, rule out endocarditis and complete 4-6 weeks of therapy

Central IV Line Infection (Temporary)

Clinical Presentation: Temperature $\geq 102^{\circ}\text{F} \pm$ IV site erythema

Diagnostic Considerations: Diagnosis by semi-quantitative catheter tip culture with ≥ 15 colonies plus blood cultures with same pathogen. If no other explanation for fever and line has been in place ≥ 7 days, remove line and obtain semi-quantitative catheter tip culture. Suppurative thrombophlebitis presents with hectic/septic fevers and pus at IV site \pm palpable venous cord

Pitfalls: Temperature $\geq 102^{\circ}\text{F}$ with IV line infection, in contrast to phlebitis

Therapeutic Considerations: Line removal is usually curative, but antibiotic treatment is usually given for 2 weeks after line removal

Prognosis: Good if line is removed before endocarditis/metastatic spread

Central IV Line Infection (Semi-Permanent) Hickman/Broviac

Clinical Presentation: Fever \pm IV site erythema

Diagnostic Considerations: Positive blood cultures plus gallium scan pickup on catheter is diagnostic

Pitfalls: Antibiotics will lower temperature, but patient will usually not be afebrile without line removal

Therapeutic Considerations: Lines usually need to be removed for cure. Rifampin 600 mg (PO) q24h may be added to IV/PO regimen if pathogen is *S. aureus*

Prognosis: Good with organisms of low virulence

Pacemaker Wire/Generator Infection

Clinical Presentation: Persistently positive blood cultures without endocarditis in a pacemaker patient

Diagnostic Considerations: Positive blood cultures with gallium scan pickup on wire/pacemaker generator is diagnostic. Differentiate wire from pacemaker pocket infection by chest CT/MRI

Pitfalls: Positive blood cultures are more common in wire infections than pocket infections. Blood cultures may be negative in both, but more so with pocket infections

Therapeutic Considerations: Wire alone may be replaced if infection does not involve pacemaker generator. Replace pacemaker generator if involved; wire if uninvolved can usually be left in place

Prognosis: Good if pacemaker wire/generator replaced before septic complications develop

Septic Thrombophlebitis

Clinical Presentation: Temperature $\geq 102^{\circ}\text{F}$ with local erythema and signs of sepsis

Diagnostic Considerations: Palpable venous cord and pus at IV site when IV line is removed

Pitfalls: Suspect diagnosis if persistent bacteremia and no other source of infection in a patient with

a peripheral IV

Therapeutic Considerations: Remove IV catheter. Surgical venotomy is usually needed for cure

Prognosis: Good if removed early before septic complications develop

Vascular Graft Infections

Subset	Usual Pathogens	Preferred IV Therapy	Alternate IV Therapy	IV-to-PO Switch
AV graft/shunt infection (Treat initially for MSSA, etc.; if later identified as MRSA, treat accordingly)	S. aureus (MSSA) Enterococci Enterobacteriaceae	Vancomycin 1 gm (IV) x 1 dose*† plus Gentamicin 240 mg (IV) x 1 dose*†	Meropenem 1 gm (IV) x 1 dose*†	Levofloxacin 500 mg (IV or PO) x 1 dose*†
	S. aureus (MRSA)	Linezolid 600 mg (IV) x 1 dose*†	Vancomycin 1 gm (IV) x 1 dose*†	Linezolid 600 mg (PO) x 1 dose*†
Aortic graft infection	S. aureus (MSSA) Enterobacteriaceae	Cefepime 2 gm (IV) q12h† or Meropenem 1 gm (IV) q8h† or Imipenem 1 gm (IV) q6h†	Ceftizoxime 2 gm (IV) q8h† or Cefotaxime 2 gm (IV) q6h†	Clindamycin 300 mg (PO) q8h† plus Levofloxacin 500 mg (PO) q24h†

MSSA/MRSA = methicillin-sensitive/resistant *S. aureus*. Duration of therapy represents total time IV or IV + PO. Most patients on IV therapy able to take PO meds should be switched to PO therapy after clinical improvement

* Follow with maintenance dosing for renal failure (CrCl < 10 mL/min) and type of dialysis (see Chapter 7)

† Treat until graft is removed/replaced

AV Graft Infection

Clinical Presentation: Persistent fever/bacteremia without endocarditis in a patient with an AV graft on hemodialysis

Diagnostic Considerations: Diagnosis by persistently positive blood cultures and gallium scan pickup over infected AV graft. Gallium scan will detect deep AV graft infection not apparent on exam

Pitfalls: Antibiotics will lower temperature, but patient will usually not become afebrile without AV graft replacement

Therapeutic Considerations: Graft usually must be removed for cure. MRSA is a rare cause of AV graft infection; if present, treat with linezolid 600 mg (IV or PO) q12h until graft is removed/replaced

Prognosis: Good if new graft does not become infected at same site

Aortic Graft Infection

Clinical Presentation: Persistently positive blood cultures without endocarditis in a patient with an aortic graft

Diagnostic Considerations: Diagnosis by positive blood cultures plus gallium scan pickup over infected aortic graft or abdominal CT/MRI scan

Pitfalls: Infection typically occurs at anastomotic sites

Therapeutic Considerations: Graft must be removed for cure. Operate as soon as diagnosis is